it was intended, that is, as a review outline for persons preparing to take examinations in elementary mathematics and mechanics.

The plan and style of this book suggest very forcibly some of the advantages and disadvantages of an examination system. Definiteness, conciseness and a certain degree of precision are encouraged but there is danger of stimulating over-use or mis-use of the memory, and discouraging breadth and originality of view and interest in larger problems that cannot be handled adequately within the space of an examination period.

BURT L. NEWKIRK.

PROBLEMS AND SOLUTIONS.

B. F. FINKEL, CHAIRMAN OF THE COMMITTEE.

PROBLEMS FOR SOLUTION.

SPECIAL NOTICE. In proposing problems and in preparing solutions, contributors will please follow the form established by the MONTHLY, as indicated on the following pages.

In particular, a solution should be preceded by the number of the problem, the name and address of the proposer, the statement of the problem, and the name and address of the solver.

The solution should then be given with careful attention to legibility, accuracy, brevity without obscurity, paragraphing and spacing, having in mind the form in which it will appear on the printed page.

Please use paper of letter size, write on one side only, leaving ample margins, put one solution only on a single sheet and include only such matter as is intended for publication.

Drawings must be made *clearly* and *accurately* and an extra copy furnished on a *separate sheet* ready for the engraver.

Unless these directions are observed by contributors, solutions must be entirely rewritten by the committee or else rejected.

Selections for this department are made two months in advance of publication.

Please send all solutions direct to the chairman of the committee.

MANAGING EDITOR.

ALGEBRA.

Solutions of 408, 409, 410, 411, 412, 413, 414, and 415 have been received. A solution of 406 is desired.

418. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Form the algebraic equation whose roots are $a_1 = 2\cos(2\pi/15)$, $a_2 = 2\cos(4\pi/15)$, $a_3 = 2\cos(8\pi/15)$, and $a_4 = 2\cos(14\pi/15)$.

419. Proposed by GEORGE A. OSBORN, Massachusetts Institute of Technology.

Show that

$$(1^5 + 2^5 + 3^5 + \cdots + n^5 + 1^7 + 2^7 + 3^7 + \cdots + n^7 = 2(1 + 2 + 3 + \cdots + n)^4.$$

GEOMETRY.

Solutions of 437, 438, 439, 440, 443 have been received. Solutions of 427, 430, 432 and 433 are desired.

447. Proposed by HORACE OLSON, Chicago Illinois.

Given the edge of a regular tetrahedron, find the radius of the circumscribed sphere.

448. Proposed by S. W. REAVES, University of Oklahoma.

Through a given point P within a given angle to draw a line which shall form with the sides of the angle a triangle of a given area [Well's *New Plane Geometry*, (1909), p. 153].

CALCULUS.

Solutions of 352, 354, 355, 356, 357, 358, 359, 361, 362, and 366 have been received. Solutions of 332, 337, 339, 340, 342 are desired.

368. Proposed by PAUL CAPRON, Annapolis, Md.

Develop $\log_{10}(x/\sin x)$ and $\log_{10}(\tan x)/x$, each to three terms, as functions of $\log_{10}\sec x$ and show that if x is less than 7° 15′ then, to five decimals,

$$\log_{10} x = \log_{10}\sin x + 1/3 \log_{10}\sec x = \log_{10}\tan x - 2/3 \log_{10}\sec x.$$

369. Proposed by I. A. BARNETT, Chicago, Ill.

Compute the definite integral $\int_a^b \log x dx$ by direct summation.

MECHANICS.

Solutions of 288, 289, 292, 293, and 294 have been received. Solutions of 268, 269, 274, 275, 277, 278, 279, 286, and 287 are desired.

296. Proposed by C. N. SCHMALL, New York City.

A force F is exerted in moving a horizontal cylinder up an inclined plane by means of a crowbar of length l. If R be the radius of the cylinder, W its weight, ϕ the inclination of the plane to the horizon and ψ the inclination of the crowbar to the horizon, show that

$$F = \frac{WR \sin \phi}{l[1 + \cos(\phi + \psi)]}.$$

297. Proposed by C. N. SCHMALL, New York City.

A shrapnel shell strikes the ground and then explodes, dispersing its fragments in all directions with a common velocity v. If A be the area of the ground covered by the fragments, and if the dimensions of the shell be neglected, show that $A = \pi v^4/g^2$.

NUMBER THEORY.

Solutions of 207, 210, 212, 216, and 218 have been received. Solutions of 189, 191, 192, 196, 200, 205, 208, 209, 211, 213, 214, and 215 are desired.

220. Proposed by E. T. BELL, Seattle, Washington.

Let $[m/n]$ denote the greatest integer that is not greater than m/n; and let the two sets,

$$\left[\frac{m}{m-1}\right]; \left[\frac{m+1}{m-2}\right]; \left[\frac{m+2}{m-3}\right]; \cdots; \left[\frac{2m-3}{2}\right],$$

$$\left[\frac{m-1}{m-1}\right]; \left[\frac{m}{m-2}\right]; \left[\frac{m+1}{m-3}\right]; \cdots; \left[\frac{2m-4}{2}\right],$$

be denoted by (A) and (B) respectively.

Prove that a necessary and sufficient condition that $2m - 1$ be a prime number is that the excess of the number of even integers in (A) over the number of even integers in (B) shall be equal to the excess of the number of odd integers in (A) over the number of odd integers in (B).

221. Proposed by THOS. E. MASON, Bloomington, Indiana.

Find numbers x such that the sum of the divisors of x is a perfect square [Carmichael, *Theory of Numbers*, p. 17].